

# Put it in Writing - if you want it remembered!

To DR. GREEN  
From DICK SWEET

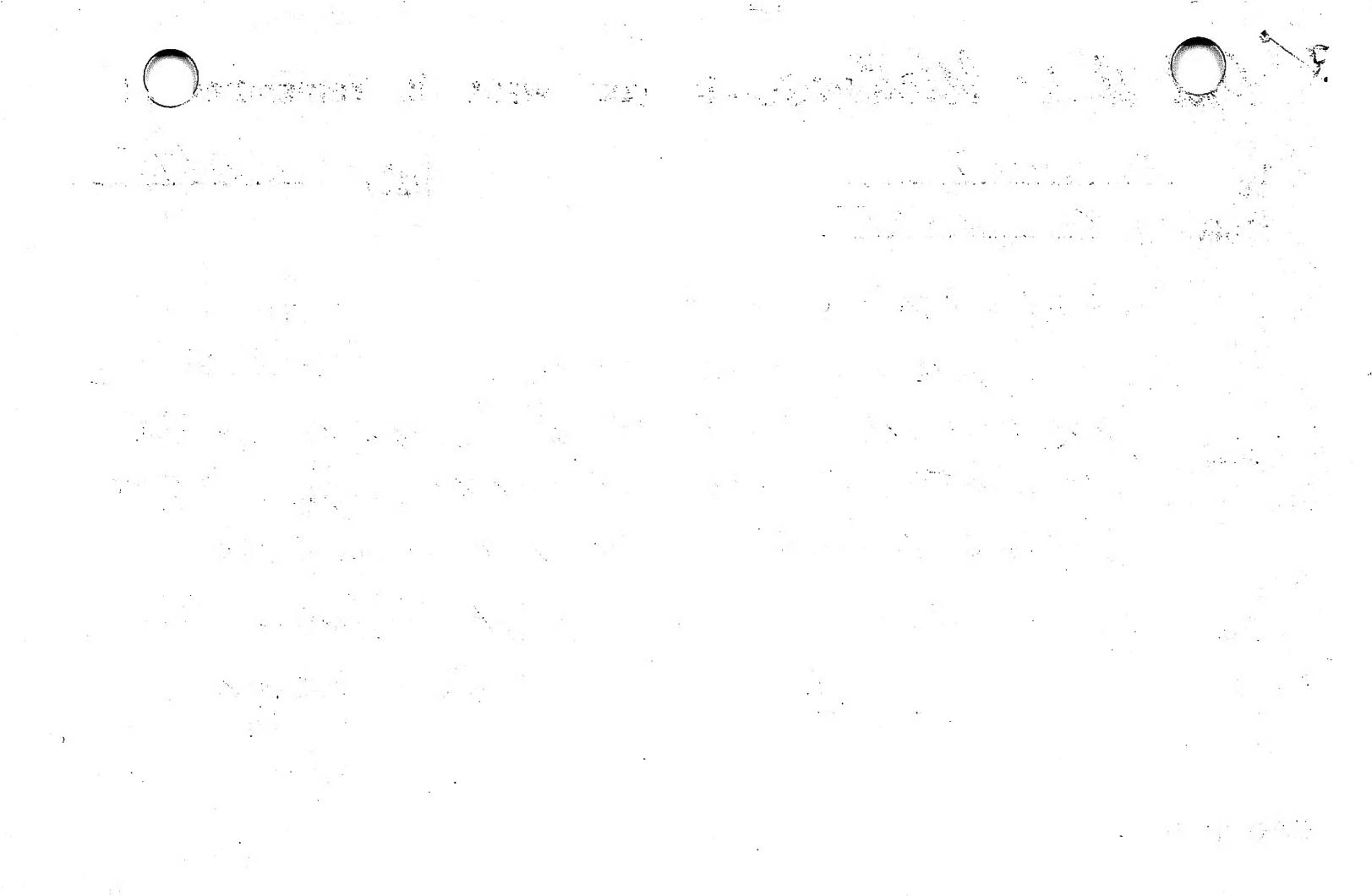
Date 7/28/75

Dear Doctor Green -

You may keep this copy of the report for your own use & that of the Watch Co. Board of Health. I have sent another copy to Steve Jenkins & Doctor Parker for Summit Co.

Best regards -

DICK SWEET





STATE OF UTAH—DEPARTMENT OF SOCIAL SERVICES

CALVIN L. RAI  
Governor

PAUL S. ROSE  
Executive Director

DIVISION OF HEALTH  
44 MEDICAL DRIVE  
SALT LAKE CITY, UTAH 84113  
AREA CODE 801

LYMAN J. OLSEN, M.D., M.P.H.  
Director of Health

328-6163  
July 15, 1975

Board of Health  
Air Conservation Committee  
Health Facilities Council  
Medical Examiner Committee  
Nursing Home Advisory Council  
Water Pollution Committee

BUREAU OF ENVIRONMENTAL HEALTH  
72 East 4th South  
Salt Lake City, Utah

R. Raymond Green, M.D., Director  
Wasatch County Health Department  
Courthouse  
Heber City, Utah 84032

Dear Dr. Green:

Enclosed is a summary of the Food Service Sanitation program survey recently conducted in Summit and Wasatch Counties.

The information obtained should be useful to you in obtaining needed supportive facilities and equipment, budgetary support, and where necessary additional program personnel. You will note that the evaluation attempts to accurately identify the strengths and weaknesses of both the sanitation and the administrative aspects of the program. A comparison of the results of this survey with previous and ensuing surveys should give an indication as to the direction in which your food program is tending.

The Utah Code of Food Service Sanitation Regulations, as adopted by the State Board of Health July 16, 1969, was used as the basis of the evaluation, and in the interest of uniformity the survey was conducted in accordance with "Procedure for Evaluating Food Service Sanitation Programs" as recommended by the U.S. Public Health Service by a survey officer duly certified for this purpose.

The close working relationship with your department is greatly appreciated. If we can be of further service to you, please do not hesitate to call upon us.

Sincerely,

Lyman J. Olsen, M.D., M.P.H.  
Director of Health

RAS:jw

enclosures

## NARRATIVE REPORT

This survey was conducted during the periods of 3/17/75 - 3/24/75, 6/10/75 - 6/13/75, and 6/18/75 - 6/19/75 by Mr. Richard A. Sweet, of the State Division of Health in company with Mr. Steven Jenkins of the Summit and Wasatch County Health Departments.

It should be noted that the protracted length of time to accomplish this survey was occasioned to accommodate two rather unique circumstances found in both of these Counties. Firstly, many of the Food Service Establishments are seasonal in nature - many of those in Summit County closing after March 30th while many in Wasatch County are not opened until after Memorial Day.

Secondly, Mr. Jenkins' heavy work load coupled with his vast geographical area of operations resulted in many time consuming interruptions delaying the course of the survey.

Of 122 food service establishments reportedly operating within the two counties, 34 were determined to comprise a statistically significant sample and representative of the total number of food service establishments within the area. (The 122 establishments represent a net increase of 5 since the last survey was concluded in Wasatch County on 1/30/74). These 34 establishments were chosen at random and were inspected for their sanitary status. Results of the inspections are appended as copies of the original inspection sheets - Utah State Division of Health Food Service Inspection Report (SDH-San-138-10/69); recorded on Report of Food Service Establishment Data (P.H.S. 4749); and summarized on Report of Food Service Establishment Program Evaluation (P.H.S. 4749-1).

Study of the data and the demerit scores can yield much definitive information pertinent to the operation of the food service sanitation program within the County. For example, contrasts may be drawn between incorporated and unincorporated areas, or one city may be compared with any other. The level of sanitation within the restaurants may be compared with that in the taverns or the school lunch units. (See figure 1). Further study will indicate the items most frequently in violation and whether they point up structural defects requiring expensive remodeling or renovation or whether, as is usually the case, only a simple change in procedure is necessary to eliminate the hazard.

### Sanitation Level

The average demerit score is an index to the sanitation status of the Food Service Establishments within the area. Since this is not a percentage it should be pointed out that the lower the average demerit score the better the sanitation rating.

Examining the scores of the restaurants alone (61 average demerits) it was found that of 26 inspected, 20 exceeded 40 demerit points, the level at which closure action should be considered. The taverns (36 average demerits) and school lunch units (45 average demerits) displayed a much better but still disappointing sanitation level. In this survey, the food service establishment with the lowest score was 10, the highest, 114, with the average demerit score of all establishments, 56. When the current survey score of 50 in Summit County

FIGURE 1 - COMPARISON OF AVERAGE DEMERIT SCORES  
Summit-Wasatch Counties

	RESTAURANTS		SCHOOL LUNCHES		TAVERNS		COUNTY TOTALS	
	Number of Inspections	Average Demerit Score						
Summit	14	54	2	46	3	30	19	50
Wasatch	<u>12</u>	<u>69</u>	<u>1</u>	<u>43</u>	<u>2</u>	<u>46</u>	<u>15</u>	<u>64</u>
TOTALS	26	61	3	45	5	36	34	56
<hr/>								
Incorporated Areas	12	55	3	45	2	30	17	50
Unincorporated Areas	14	66	--	--	3	41	17	62

is compared to the two scores of 44 attained there on previous surveys and the 64 in Wasatch County is compared to the two previous scores of 48 and 61 respectively, attained there, a progressive and serious deterioration in the sanitation status of the Food Service Establishments is demonstrated. This score places the sanitation level in range IV which indicates that the overall sanitation status of the food service establishments is inadequate to meet public health needs and that steps should be taken to secure correction of existing deficiencies according to the following suggested guide:

- a. When the demerit score of the establishment is 20 or less, all violations of 2 or 4 demerit points must be corrected by the time of the next routine inspection; or
- b. When the demerit score of the establishment is more than 20 but not more than 40, all items of 2 or 4 demerit points must be corrected within a period of time not to exceed 30 days; or
- c. When one or more 6 demerit points items are in violation, regardless of demerit score, such items must be corrected within a period of time not to exceed 10 days.
- d. When the demerit score of the establishment is more than 40, the permit is immediately suspended.

The following is a listing of those items of sanitation found to be in frequent violation by the establishments in the survey sample (see figure 2). Those items having four or less demerit points which are violated by 50% or more of the establishments and those items having six demerit points and violated by 10% or more of the establishments are of special concern and have been singled out for comment. The first number in parenthesis following the inspection report item number is the demerit value of that item and the second number is the percentage of establishments found in violation of that item.

18. (2) Containers of Food Stored off the Floor on Clean Surfaces

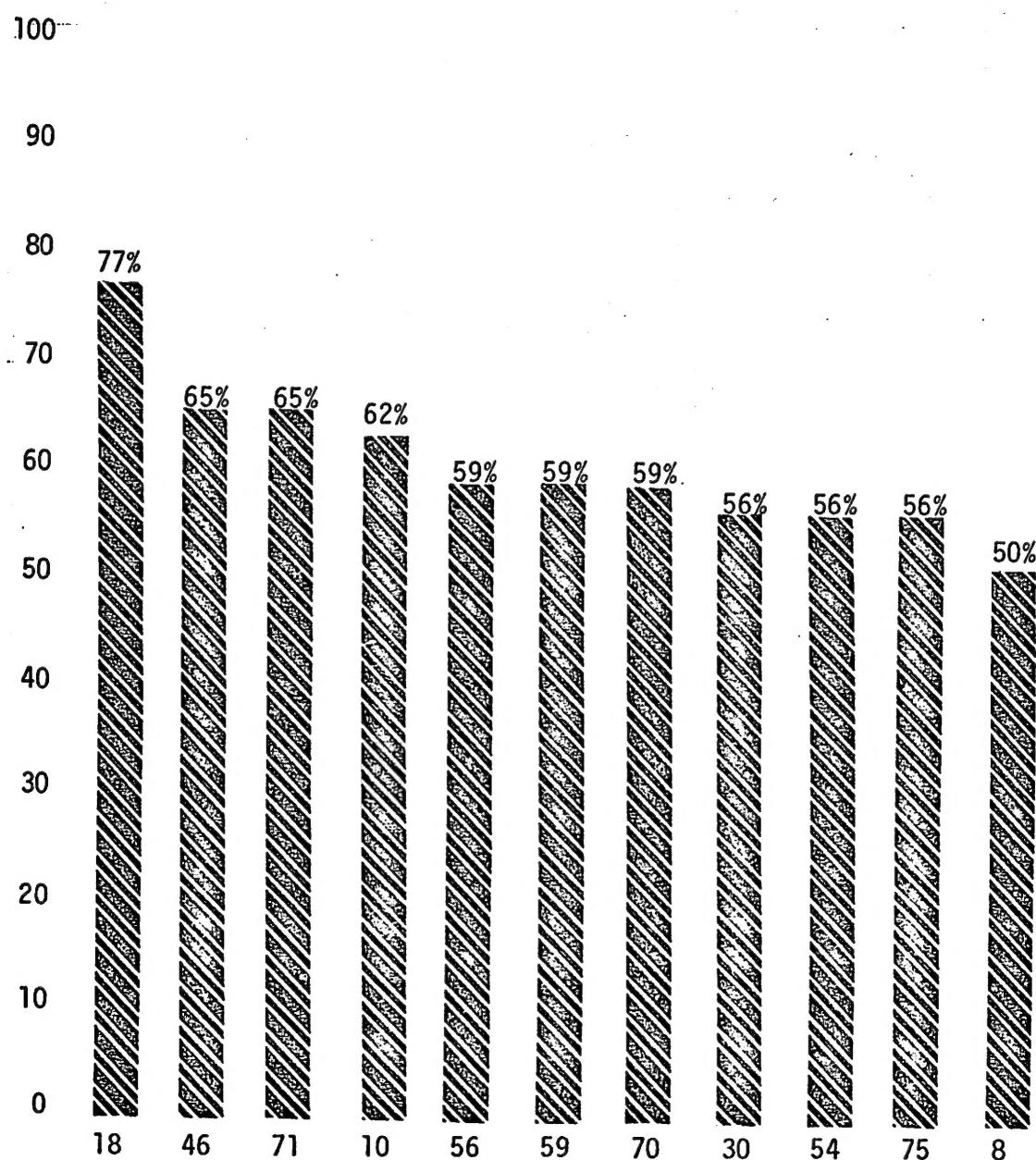
Food-stuffs were found stored directly on the floor, exposed to splash and other contamination. Storage in such a manner may become a significant source of contamination particularly for those items which are not subject to further heat processing. Sealed products such as canned goods stored on the floor make it exceedingly difficult to adequately clean floors.

46. (4) Facilities for Washing and Sanitizing Utensils and Equipment

A variety of violations were involved in this item. Many establishments lacked 3 compartment sinks for the manual washing and sanitizing of utensils and equipment. In many of the establishments having mechanical dishwashing machines, the machines were not being operated or maintained in a manner so that adequate wash or sanitizing temperatures were achieved. Several faulty temperature gauges were noted and several establishments were not placing the sanitizer in the proper vat.

FIGURE 2 - ITEMS OF FREQUENT VIOLATION

SUMMIT-WASATCH COUNTIES



- INSPECTION REPORT ITEM NUMBER -

71. (2) (65%) Equipment Properly Installed

Vegetable sinks used to wash and prepare food were the predominant violators of this item. They were found to be connected directly to the sewer lines without an air break, thus presenting a potential problem of backflow and contamination of food substances.

10. (2) (62%) Thermometers Properly Located

Easily observed indicating thermometers should be located in the warmest part of all refrigeration units, except freezers, to assist food-service personnel in assuring that proper temperatures are being maintained.

56. (2) (59%) Single Service Articles Properly Stored, Dispensed, and Handled

In most instances this violation was due to cups, straws, toothpicks, and plastic spoons being stored in open containers or in a manner which failed to protect these items from contamination. Single-service articles should be stored in original containers or approved dispensers which protect them from contamination and should be handled and dispensed so as to prevent contamination of surfaces which may come in contact with the mouth of the user.

59. (6) (59%) Water Supply Adequate and From Approved Source

Water, if not of a safe and sanitary quality, may serve as a source of contamination to food or equipment and result in transmission of disease or be the cause of other illness. Many of the water supplies serving the food service establishments were in the unapproved category.

70. (6) (59%) Back Siphonage

The most common violation of this item was threaded hose bibbs without effective back siphonage protective devices. A few hoses were found connected to the water supply and extending below the overflow level of the wash sinks. The water inlets of several potato peelers and frozen dessert dipper wells were found to extend below the equipment's overflow level.

30. (4) (56%) Good Hygienic Practices

Again a variety of insanitary practices contributed to the frequent violation of this item. In 13 establishments the practice of washing hands in the vegetable preparation or utensil washing sinks was observed. (As a contributing factor to this; frequent violation of item 76 was also noted and comments on this item follow).

In several cases smoking in food preparation areas or other un-approved places was observed. Hands easily become contaminated by saliva during the smoking of cigarettes, therefore it is important that smoking be permitted only in designated areas where no contaminating hazards

will result and after smoking, food service personnel be required to wash hands before returning to work.

In several establishments laundry washing and drying machines were located within food preparation, food storage, or clean equipment storage areas. Because of the probability of aerosol contamination from this type of equipment, it should be excluded from these sensitive areas and the only linen allowed to be so laundered on the premises should be limited to that involved with food operations.

In additional instances, such practices as the storage of garbage receptacles and clothing on food preparation surfaces and the traffic of unauthorized persons through the kitchen were noted.

54. (2) (56%) Storage of Cleaned and Sanitized Utensils and Equipment

Clean dishes and utensils were being stored on toweling instead of on a clean, properly constructed and maintained storage surface. Silverware was found "pre-set" on tables and counters in advance of the normal eating time. In many cases dishes, trays, bowls, etc. were not inverted in unprotected storage.

75. (2) (56%) Toilet Tissue and Proper Waste Receptacles Provided

Covered receptacles were not provided in many women's toilet rooms and in several cases receptacles were absent - usually in the men's toilet rooms.

8. (4) (50%) Protected from Contamination

Protective measures are required to prevent contamination of food by flies, dust, coughing, and sneezing while it is being stored, prepared, displayed, and served in food service establishments. Open displays, uncovered containers exposing food stored in refrigeration units, food stored on the floor, food stored under overhead sewer lines, exposed ice cream cones, and the use of wet toweling as a food cover, all allow for contamination and were documented in 50% of the survey samples.

25. (6) (44%) Bactericides and Cleaning Compounds Properly Stored

Bactericides and cleaning compounds were stored with food. This material should not be stored in the same cabinet or area of the room with food or insecticides, rodenticides, or other poisonous materials.

62. (6) (44%) Ice Manufactured from Water Provided by a Municipal Supply or other Approved Source

Ice used for any purpose is to be made from water which comes from an approved source for the reasons stated in "Item 59" above.

72. (6) Tiolet Facilities

The violation of this item was mainly failure to comply in the design and construction of plumbing fixtures as specified in the Utah Plumbing Code.

24. (6) Poisonous and Toxic Materials Properly Stored

A large number of these violations were due to establishments having poisonous and toxic materials stored with the food or with bactericides and cleaning compounds. This material should be stored in cabinets which are used for no other purpose, or stored in a place outside the food storage areas, preparation areas, clean equipment or utensil storage areas. There were several instances of unapproved insecticides being used on the premises.

12. (6) Potentially Hazardous Food

Food containing milk or milk products, meat, poultry, fish, and eggs, when not maintained at 45° or below, or 140° or above, is capable of supporting rapid growth of infectious or toxigenic microorganisms. Most of the violations resulted from failure to maintain temperatures below 45° in refrigeration units or in sauces and creamers at 55° or below during periods of service.

76. (6) Lavatories Provided, Convenient

Food service personnel in eighteen percent of the establishments did not have access to hand-washing facilities located within or immediately adjoining the food service area. As a corollary of this it was observed that hand-washing was being accomplished in utensil or food preparation sinks in violation of the Code. The presence of convenient hand-washing facilities encourages frequent usage of these facilities, which is extremely important in preventing the transmission of foodborne disease.

Administrative Level

The program operations numerical score is an index to the quality of the administrative procedures employed in the Food Service Sanitation Program in the County.

In the survey the numerical score was 60 and though quite comparable to the 62 attained in Summit County on the last survey and an infinite improvement over the 36 scored in Wasatch County on the last survey there, still the numerical score of 60 places the administrative level in range IV which indicates that the administrative procedures employed are grossly inadequate to meet the public health needs in food protection. Immediate measures should be taken to upgrade the administrative aspects of the program.

The following comments relate to the nine administrative program operation areas evaluated in the survey. There is a maximum of 100 points allowed for full compliance. The first number in parenthesis following the program operation is the credit scale for that item and the second figure is the credit allowed in the survey.

1. Interpretation of Requirements (0 - 10) (8)

The staff is competent and generally knowledgeable in Food Code interpretation. Since there were no recent inspections in Summit Counties' files and none completed to date in Wasatch County upon which to evaluate the adequacy of interpretation requirements, this determination was made through discussions held during the field inspections. This experience together with on-going inspection activities will hopefully provide increasing skill to an already adequate ability in interpretation of sanitation requirements. When an inspectional program is implemented, care should be exercised to consistently and accurately report to the operator all violations each time they occur since this is basic to obtaining either the compliance of the operator or the support of the courts in a successful enforcement action.

2. Administrative Procedures

a. Evaluation of Records (0 - 10) (9)

All inspection report forms, notices, correspondence and other vital information concerning each establishment is complete and kept in a neat and orderly manner. Such records are kept in the active files for at least two years or as required by law.

Inspection report findings need to be summarized in a manner, such as ledgering, which permits easy identification of repeat violations in each establishment.

The inspection reports are filed within 15 days and in a manner that they can be retrieved from the files within a reasonable period of time.

b. Frequency of Inspections (0 - 5) (0)

Inspections of each establishment should be conducted as a minimum each six months if the food service sanitation program is to have even marginal effectiveness. Experience has shown that inspection of most of the establishments at a greater frequency is desirable to achieve satisfactory compliance.

In Summit County inspections are only being accomplished once a year and none have been done as yet, under the new administrative alignment in Wasatch County.

c. Enforcement Procedures (0 - 15) (5)

Germane to this section would be provision to assure close liaison with proper legal advisors; the local adoption of a permit system for both the establishment and the employee; proper hearings; examination and condemnation of food and the exclusion of infected food handlers from the food service

establishment. Procedures should be immediately instituted in this context to include the local adoption of the Utah State "Code of Food Service Sanitation Regulations" or its equivalent.

3. Staff Training (0 - 5) (5)

Full credit was awarded for this item. Staff appeared to have adequate reference material available. Since continuous training of all food sanitation personnel is necessary to develop and maintain staff competencies, such training should be implemented through such programs as short courses, seminars, professional meetings, staff meetings, conferences, joint inspections with trained personnel, viewing training films, and self-education activities including the reading of textbooks and trade or professional journals.

4. Industry Training (0 - 5) (4)

The local health authority's efforts to assist in industry training should take several forms, such as formal or informal group training, instruction during inspections, distribution of printed information or assisting management in the training of food service personnel. The adoption of suitable local ordinances requiring food handlers to hold permits as a condition of employment in a public eating or drinking establishment is urged. The conditions for issuance of such permits should be a thorough knowledge, evidenced by written exam, of applicable ordinances and regulations and suitable attitude toward public health protection. At the present time only voluntary food service employee instruction is being offered in Summit County.

5. Public Information (0 - 5) (1)

Keeping the public informed about the food sanitation program is another important phase of Health Department operations. An informed public is more aware of the needs, goals, and values of a good sanitation program. Such awareness contributes to public understanding and program support necessary to achieve desirable objectives. The dissemination of information should be accomplished by a number of different methods or media--radio, T.V., press, and addresses to civic, fraternal, and professional organizations. Its primary value comes when it is a regular and continuing program. The dissemination of information is presently accomplished only on a "one-shot", special problem release basis. Copies of news releases which may be adopted to your program were discussed and delivered to the sanitarian at the time of the oral evaluation.

6. Program Support (0 - 10) (3)

Again, a well ordered public health effort in this area cannot be limited to a single measure. The provision of adequate laws, an adequate number of competent program personnel, and sufficient funds for travel, materials, and equipment are minimum essentials.

The present staff, though possessing very high qualities, is at an inadequate manning level. This inadequate staffing problem is further aggravated by the relatively large per capita number of food service establishments, the extensive geographical area of operations, and a population growth which at 13,000 people represents an increase of 400 within just the past 2 years. Nor do these population figures take into account the fact that these two counties are prime recreational areas with exploding development wherein during certain periods of the year the transient population will exceed the permanent resident population by several times. For example taking the case of Park City alone, the permanent residential population is approximately 1,500, while during the height of the ski season at Christmas this expands to an estimated 10,000. The health and sanitation support requirements must be available to accommodate the higher peak population. Further, in Summit and Wasatch Counties it is seen that while the per capita number of food service establishments of 1/107 exceeds the national average of 1 per 352 people by nearly 3 1/2 times, the staffing is far below the present recommended minimum suggested standards of one sanitarian per 15,000 population or one full-time field sanitarian per 150 food service establishments if engaging in no other environmental health programs. Current references for this may be found in the Utah State Division of Health's "Regulations, Standards and Recommendations for District and City-County Health Departments" Item 2 Appendix B, Page 20, and International City Managers Association's "Administration of Community Health Services," 1st Ed., 1961, Chapter 8, Page 157.

Other considerations that appear to be inhibiting a better food service program (as well as the sanitation program in general) are lack of sufficient clerical help, inadequate budget projections, and lack of local adoption or enforcement of suitable food service sanitation codes.

#### 7. Plan Review (0 - 5) (1)

To insure compliance with sanitary requirements, to prevent any misunderstanding by the operator as to what is required, and to prevent errors which might result in additional costs to the operator, it is very important that the health authority thoroughly review properly prepared plans and specifications for any new or extensively remodeled food service establishments before such work is begun. Such service is now being offered only on a special request basis.

#### 8. Supporting Facilities and Measures

The purpose of any food service sanitation program is primarily to prevent foodborne illness. Despite efforts to this effect, it is known that many outbreaks are occurring. The intent of this section is to prepare your program to meet the demands which would be placed upon it when an outbreak is reported. All local health authorities should have competencies in this area.

a. Laboratory Facilities and Services (0 - 5) (5)

At the present time, the Utah State Division of Health Laboratory, 44 Medical Drive, Salt Lake City, Utah, is available and currently being utilized by the Summit and Wasatch Health Departments. All necessary analyses can be performed there.

b. Field Equipment (0 - 10) (8)

Basic items of equipment such as indicating and maximum self-registering thermometers, chemical test kits, light meters, and flashlights are available and used. Water pressure gauges should be obtained.

c. Preparedness for Foodborne Disease Outbreaks (0 - 10) (6)

A written documented plan of operation for the investigation of foodborne disease outbreaks needs to be developed. An adequate number of properly maintained and strategically located, pre-assembled sample collection kits should be available. All suspected foodborne disease outbreaks are being investigated and reported to the Central Office of the Utah State Division of Health. In this connection, an epidemiological investigation team together with certain sampling equipment is available from this Division upon request to assist in this effort.

9. Food Service Establishments Outside of Your Area of Jurisdiction (0 - 5) (5)

The trend of interjurisdictional movements of prepared food for direct service to the consumer continues to increase. The sale of food received from a food service establishment not under local jurisdiction may be permitted if such establishment: (a) operates under regulations substantially equivalent to the Utah Code of Food Service Sanitation Regulations, (b) is under routine official supervision, (c) is located in a community which has been awarded by a public health service certified survey officer of the State, a sanitation rating equal to that of the receiving community, on the basis of the public health service evaluation method. There are no known vendors currently operating in this two county area who may raise possible problems inherent in the interjurisdictional movement of food.

However, should the advent of the vendors occur, procedures should be immediately established to permit acceptance of reports from responsible authorities in other areas where such food service establishments may be located.

Summary

Summit and Wasatch Counties are to be sincerely complimented for their present organizational effort and for the unusually high quality of the

professional staff. These are necessary prerequisites to achieve improvement in the sanitary level of the Food Service program. With these staff improvements, however, there yet remains a great disparity between the man-power level and the workload requirements.

Sufficient frequency of inspection and follow-up effort is not possible under these circumstances. In the final analysis, most progress in public health comes as a result of a judicious balance between the educational process and legal enforcement. To be successful in this effort close and continuous follow-up must be maintained with the food service establishments. The need for this requirement is further emphasized by the annual employee turnover rate of 90% currently being experienced in the Nation's restaurants.

The present inadequate manning level; the lack of local health ordinances and the consequent lack of any enforcement effort; the lack of food service employee training and public information program; no requirement for plan reviews and unpreparedness for foodborne disease outbreaks have all combined to produce the observed shortcomings in both the administrative procedures and sanitation level.

Some of the items of frequent violation indicate that community-wide problems exist. Examples of these are solid waste disposal, open burning, and unapproved water supplies. It is unrealistic to single out a restaurant per se for abatement proceedings when the water utility is supplying unapproved water to an entire community or when the governmental jurisdiction is maintaining an unapproved dump in violation of minimum State Regulations. All are interrelated and should be corrected.

Food service sanitation has traditionally been one of the cornerstone programs in public health. Nationally, the food service industry ranks third in dollar volume among all industries. Much progress has been achieved in the control of foodborne illness yet despite this progress foodborne illness continues to be a major public health problem as there remains more reported illness associated with the consumption of food than from all other environmental factors combined. To the end that we may mutually reduce the proportions of this problem it is projected that a comprehensive evaluation of your food service program will be attempted at least every two years. In the interim between evaluations, State Division of Health staff will be available to assist you in this program upon your request.

# On the way: fresh water from sewage

Unthinkable to drink  
purified wastewater?  
Most of us already do

By JOSEPH F. WILKINSON

Earth is a spaceship with a finite supply of water on board. Yet it takes on an additional 70 million passengers every year. Where will the additional water come from to meet the needs of its growing population? The easy sources of fresh water have long ago been exploited. The water yet to be tapped becomes more expensive to reach, treat, and deliver. Many cities in the U.S. and around the world are taking a hard look at recycling sewage to provide a vital freshwater supply.

There is a compelling logic in turning to sewage as a source of potable water. If a community can recycle 80 percent of the water it uses, it can increase its water supply by 400 percent.

Denver recently became the first city in the U.S. to embark on a long-range program of recycling its sewage for drinking water. In about 25 years, Denver expects to get 25 percent of its fresh water from purified wastewater.

"Man has the technology to take out of water anything that he puts into it," says James L. Ogilvie, manager of Denver's Water Board. "We'd be foolish not to do it."

Wastewater recycling has been tried before. During a severe drought in 1956-57, Chanute, Kan., mixed the effluent from its secondary-treatment plant with water from the Neosho River for five months. There were odor and col-

or problems, and many of Chanute's 12,000 residents used bottled water for cooking and drinking, but the wastewater reuse got the town through the emergency. For two months during a similar crisis, the Ottumwa, Iowa, water-treatment plant drew water from the Des Moines River that contained from 33 to 50 percent raw sewage from Des Moines, 70 miles upstream.

Windhoek, South Africa, with a metropolitan-area population of 84,000, currently recycles about one-third of its sewage effluent—about one million gallons per day—after extensive treatment.

In deciding to recycle wastewater, Denver is really following a

**¶ The word wastewater should be dropped from the vocabulary... There is no such thing as new water ¶**

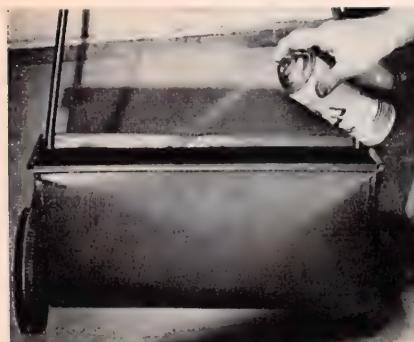
practice that has been tested, but seldom thought about by the general public. One-third of the population of the U.S. lives in the 155 municipalities that take their drinking water from streams that contain one gallon out of 30 that has been used previously. In extreme cases, one out of every five gallons has been used before.

Towns, cities, and entire metropolitan areas take water out of rivers and lakes and return most of it downstream as treated sewage. The next community downstream does the same, and so on. Most of us drink recycled sewage whether we want to think about it or not.

A nationwide Gallup survey taken for the American Water Works Association in 1973 showed that four out of 10 Americans would have no objection to drinking recycled sewage if their community health authorities said it was safe. In Denver, where there is a program to publicize wastewater reuse, 85 percent of residents surveyed said they would be willing to drink recycled water if its quality were the same as Denver's present supply. George Burke, manager of technical services for the Water Pollution Control Federation, says, "Sewage is mostly pure water."

When sewage reaches a treatment plant, it first passes through screens that remove large objects like sticks, rags, paper, plastic bottles, and grapefruit rinds. After the screening, sewage passes slowly through a grit chamber, a large tank where gravel and sand settle out. The sewage still carries dissolved organic and inorganic matter and suspended solids, which are small particles of the great variety of wastes that water carries away. The sewage flows yet more slowly through sedimentation tanks, and about half of the suspended solids settle to the bottom. This is known as primary treatment. In about one-third of U.S. municipalities, a primary treatment, plus a shot of chlorine to kill bacteria and odor, is all the processing the sewage gets before it's discharged into a lake or stream.

But in the communities that house half the U.S. population—Denver among them—the effluent gets a secondary treatment, which is a speeded-up version of natural



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The real trial-by-fire was the sliding carbon holder on my carbon-arc torch. Other lubes were quickly burned out by the intense heat, but Slip-Plate stayed put.

The paint is also available in liquid form. Check large retail chain stores, or write Superior Graphite Co., 20 N. Wacker Dr., Chicago, Ill. 60606.—E. F. Lindsley



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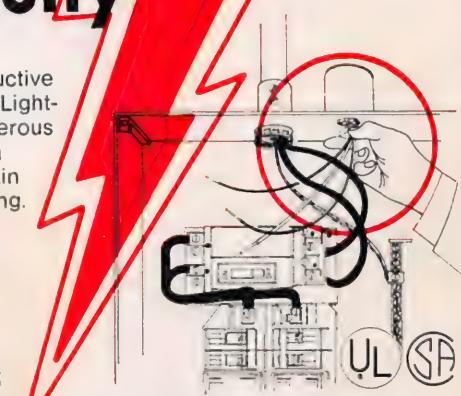
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water-purification processes. Effluent from primary treatment is exposed to bacteria that consume the organic matter and also absorb some nitrogen and phosphorus compounds.

There are two main forms of secondary treatment:

- The trickling-filter process passes sewage slowly through broad, deep beds of stones on which bacteria grow.
- In the activated-sludge process, sewage passes slowly through huge tanks heavily populated with bacteria. A steady flow of air bubbles from the bottom helps the bacteria do their job.

At the end of secondary treatment, chlorine is added to kill the bacteria. An efficient secondary-treatment plant can produce an effluent that is 99.8 percent pure.

**“There are hundreds of organic chemicals from industry that we know are harmful, and pesticides that we know are poisonous”**

Although the remaining contaminants amount to only two-tenths of one percent, it's a costly, complicated two-tenths to take out. There are five different kinds of impurities to cope with: suspended solids, nonbiodegradable organic matter, plant nutrients, inorganic substances, and bacteria and viruses.

“Suspended solids include particles of dirt and clay,” says R. D. Heaton, reclamation engineer in the Denver Water Board laboratories. “They make the water look muddy and probably aren't harmful, although bacteria and viruses could hide in them. The main reason for removing them is to make the water look better.”

“Nonbiodegradable organic matter is material like DDT that stays in nature a long time and won't degrade on its own. There are hundreds of organic industrial chemicals that we know are harmful and pesticides that we know are poisonous.”

The Environmental Protection Agency recently found some of these chemicals (such as carbon tetrachloride, carbon disulfate, chloroform, dieldrin, and endrin) in drinking water drawn from the lower Mississippi River. The EPA attributes the area's higher-than-normal incidence of intestinal can-

cer to these chemical pollutants.

“Plant nutrients are mainly nitrogen and phosphorus from detergents, and runoff from fertilized fields,” says Heaton. “They're usually removed because they stimulate the growth of algae and other aquatic plants, but nitrogen in certain forms can be harmful.”

“The inorganic substances are traces of metals, like cadmium, sodium, iron, mercury, zinc, lead, and dissolved salts and acids,” says Heaton. “We want them out because of their possible toxic effect. There's reason to believe that cadmium and sodium contribute to heart disease, and mercury is definitely toxic.”

All these impurities can be removed through advanced wastewater treatment (AWT), but there's no single process that can remove them all economically in any useful volume. Instead, AWT uses a process train, a series of steps that cope with one or more kinds of impurity at a time.

The Denver Water Board is currently purifying secondary effluent in a five-gallon-per-minute pilot plant. This year, design will begin on a one-million-gallon-per-day AWT demonstration plant that the board plans to have operating by 1977. To demonstrate its purity, water from this plant will be used for irrigation, industry, and recreation. The board is confident that by 1990 it will have learned enough about cleaning up wastewater to design and build a 100-million-gallon-per-day plant to make drinking water out of sewage.

When this plant is on line, says the water board, it would produce water that costs from 70 to 80 cents per 1000 gallons—competitive with other sources of supply.

Heaton describes how the one-million-gallon-per-day plant probably will work. The first step is to get rid of the suspended solids. Lime mixed into the secondary effluent coagulates the particles. As the solids clump together, they sink to the bottom of the tank. This coagulation also removes phosphorus compounds and picks up some free-metal particles. Lime also makes the effluent highly alkaline, killing many bacteria and viruses.

After coagulation the effluent goes to a device like the mechanical-draft cooling towers that power plants use to take the heat out of their cooling water. The effluent flows in at the top and cascades over layer after layer what looks like large venetian blinds.

slats. This is the essential part of a new patented process known as the Ammonia Removal and Recovery Process.

“Because of the high alkalinity of the effluent after the lime treatment, most of the nitrogen is in the form of ammonia gas,” says Heaton. “Fans at the top of the tower strip out the ammonia when the effluent is exposed to the air. The ammonia is collected at the top and mixed with a sulfuric-acid solution. This produces ammonium sulfate, which will be sold as fertilizer. After the ammonia stripping, the effluent goes to a tank where carbon dioxide injected from the bottom lowers the alkalinity and softens the water.

“By this time, the effluent is very clear water,” says Heaton. “It then goes through a tri-media filter—layers of sand, crushed coal and garnet sand—that removes any remaining suspended solids and some bacteria, viruses, and phosphorus.”

About halfway through the advanced treatment, the effluent gets an application of chlorine, which takes out remaining nitrogen compounds by oxidizing them to nitrogen gas. As a side benefit, the chlorination kills almost all the bacteria that have survived.

After chlorination, the effluent flows into large vertical tanks packed with activated carbon. This removes the synthetic organic compounds. The particles of carbon in the tanks have large surface areas, because they are porous.

**“It's got to be a fail-safe system. We'll have redundancy coming out of our ears”**

They can adsorb—that is, hold onto—these organics. They also pick up bacteria and metals.

The water-board planners haven't yet decided on the demineralization process it will use to take out dissolved salts, minerals, and organics. According to Heaton, it will probably be either reverse osmosis or electrodialysis.

In reverse osmosis, water is forced through a plastic membrane that won't permit impurities to pass through. In electrodialysis, the effluent passes between two membrane walls. Behind one wall is an anode, behind the other a cathode. Positive and negative charges of electricity draw the negative and positive-charged ions across the membranes.

chemical compounds through the membrane walls, leaving pure water behind.

Whichever of the two methods the water board finally chooses for its process train, the other will be built into the system, along with alternative demineralization operations, to see which is the most effective.

Finally, the proposed plant will make use of ozone to remove organics and bacteria, and a final chlorination to knock out any bacteria that might possibly have survived the processing. Ozone is absorbed in the water as dissolved oxygen.

"It's got to be a fail-safe system," says Heaton. "We'll have redundancy coming out of our ears. We'll have almost a duplicate system to take care of failures and maintenance. There'll be more than two of some things, such as tri-media filters, activated-carbon tanks, and demineralization units, so if something goes out or has to be repaired, we can switch over. We'll also have computer-linked monitors throughout the system so that any malfunction will be automatically taken out of the line."

The water-board engineers will refine this demonstration unit to the point where it can turn sewage into a product identical to the melted-snow-quality water that Denver drinks today. Then it will begin work on the 100-million-gallon-per-day plant.

#### Denver's not alone

Although Denver is now alone in advocating direct human use of recycled wastewater, it has quite a bit of fellowship in advanced wastewater treatment:

- The Virginia State Water Control Board is building a 10-million-gallon-a-day AWT plant, expandable to 15 million gallons, that will discharge potable water into its Occoquan Reservoir, in Fairfax County, about 25 miles upstream of the water-supply intake. "With this project, we decided to reuse water in a more responsible manner," says Norman M. Cole Jr., board chairman.

- The Washington, D.C., Suburban Sanitary Commission will build two AWT plants, one of 60-million-gallon-per-day capacity in Montgomery County, Md., and a 309-million-gallon-per-day plant at Dickerson, Md. Both will discharge into the Potomac River upstream of water-supply intakes.

- At South Lake Tahoe, Calif., a 7.5-million-gallon-

per-day AWT plant turns secondary sewage into pure water to preserve the clarity of Lake Tahoe. The product is exported to a site 28 miles away to form a lake for recreation and irrigation.

- Dallas has an extensive research program aimed at producing drinkable water, not for drinking, but as a backup for a municipal water supply that is threatened with shortages. "It is only a matter of time until all water utilities will have to consider the matter of water reclamation and reuse, at least to some degree," says Henry Graesser, director of Dallas Water Utilities and a former president of the American Water Works Association. "In the southwestern and western U.S. it is not a matter of time. The areas are living with the problems."

- St. Petersburg, Fla., will build a \$3.8 million, 20-million-gallon-per-day AWT plant that will produce water primarily for lawn sprinkling. Another objective is to eliminate discharge of wastewater into the bays around the city. The AWT process will keep the nutrients in the effluent to act as fertilizer. When demand for sprinkling water is less than supply, the excess AWT water will be injected into the aquifer through a 1200-foot-deep tube.

- The Environmental Protection Agency in just this current fiscal year is investing \$7.2 million in AWT research, of which \$4.3 million finances projects carried out by various sanitary agencies. And a survey by the agency shows that at 358 sites in the U.S., wastewater is recycled at various degrees of purity, about 60 percent for irrigation and most of the rest for industry.

Says L.G. Suhr, of CH<sub>2</sub>M-Hill Engineers, who played a major role in the Lake Tahoe reclamation project and who represents his firm in designing the Denver demonstration plant: "The word wastewater should be dropped from the vocabulary and along with it the term sewage. You should realize there is no such thing as new water; nearly all water on the earth's surface has been used and reused in one way or another. Perhaps we should refer to the water that carries our waste as 'transport water'. Then in treatment plants the pollutants can be removed from the water to produce pure water. The result might be unacceptable to the public than to get them to drink 'reused sewage.'"



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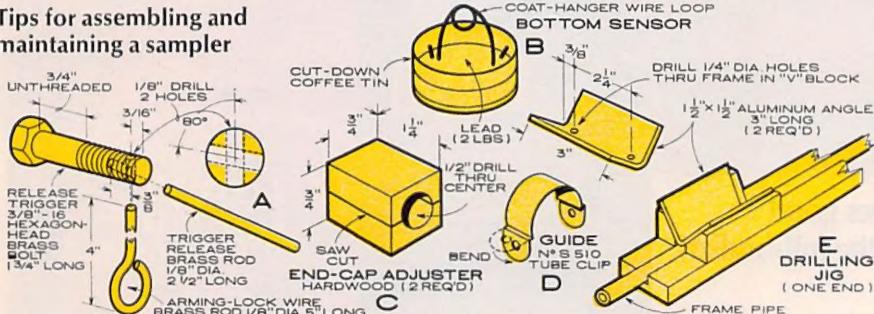
Armed to trigger at proper depth, sampling unit is eased into water from a boat deck.

# Automatic Water Sampler Monitors Pollution

**Low-cost, easy-to-build unit is real contribution to your local ecology group**

By FRANK B. RAKOFF

## Tips for assembling and maintaining a sampler



Materials specified minimize saltwater corrosion. You can improvise as necessary. Use PVC plastic pipe from plumbing-supply stores for the sample bottle. Be sure the ends are square and flat, then smooth them on sandpaper fixed to a flat surface. Drill and tap the drain-fitting hole; bed this fitting with a sealant such as silicone rubber. Drill the plumber's drain plungers (used as stoppers) for the shock-cord spring, and trim their diameter so they will not contact the frame pole. The hole through the split wooden bushing should provide a seal by compressing the spring, but caulk between the wood and the spring is a good precaution.

Now thread the spring through the end caps and bottle and prepare one end as shown. Then, with this end cap pushed into the bottle, secure the other end-cap adjuster

interested in water conservation? Volunteer ecology groups throughout the country, concerned about polluted rivers, lakes, and sounds, are working to conserve water resources. Since water sampling at different depths is often necessary, you might contribute to a local program by building this automatic sampler.

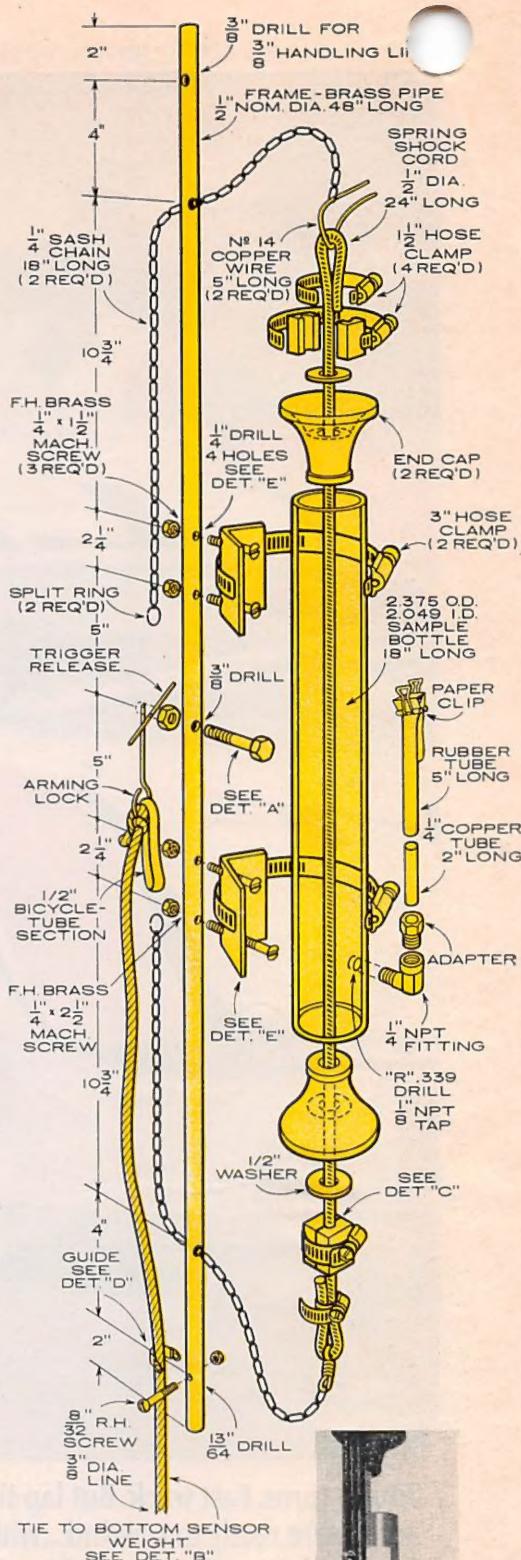
Here's how you use the sampler: First, the length of the trigger-release line is adjusted. The distance between the hollow cylinder and bottom-sensor weight tied to the line is the sample depth. Next, the inner-tube section attached to the arming lock is temporarily looped over the longer (lower) frame bolt. This prevents the trigger-release bolt from turning.

Now pull one rubber end stopper several inches away from the cylinder, stretching the spring (photo below). Secure the stopper by looping the sash-chain ring over one side of the arming lock. Similarly, stretch and secure the other stopper.

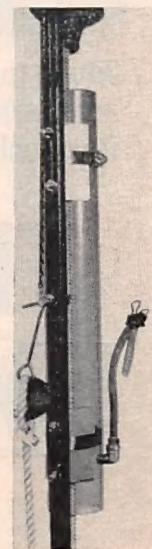
Hold the sampler over the side of the boat, with the bottom sensor hanging free. Unhook the inner-tube section from the frame bolt; line tension from the sensor weight now prevents the trigger-release bolt from turning.

Lower the sampler with the handling line until slack indicates you've touched bottom. When the bottom sensor slackens the trigger release, spring tension will draw the stoppers into the cylinder.

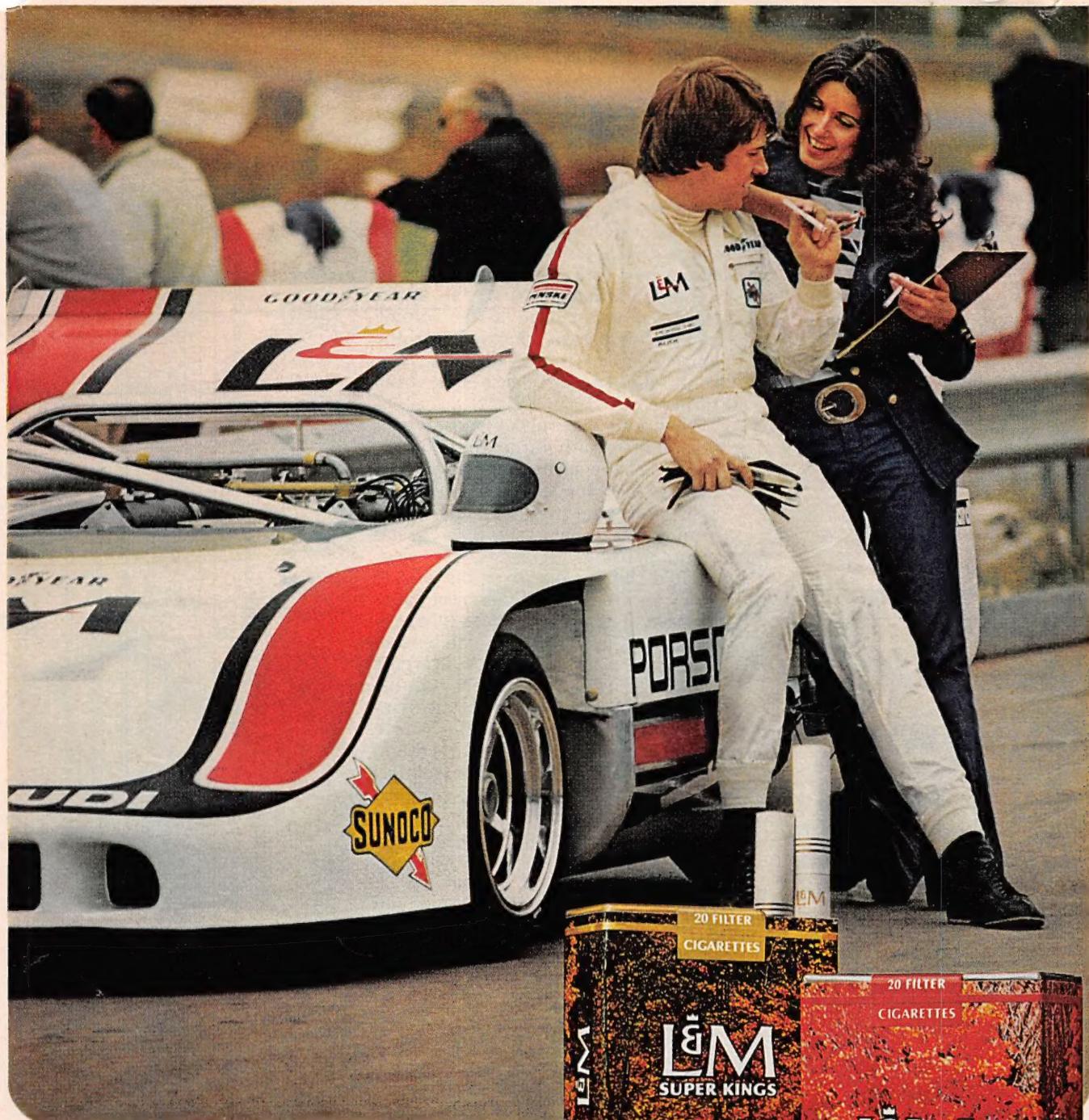
To recover the water sample, remove the drain-tube paper clip and place the tube in the storage vessel. Relieve the vacuum at the upper end of the bottle by cracking the seal between end cap and bottle. **PS**



while simultaneously stretching the spring with about five pounds tension. Cut off the excess spring stock. The wooden jig in detail E can simplify aligning and drilling holes through the two spacers and pipe frame. After drilling the trigger-release bolt, install it on the frame and tighten the nut. The bolt should turn freely, but should not be too loose. If the bolt does not have the proper unthreaded length, keep the nut in place by upsetting both bolt and nut threads with a punch. Install the trigger-release pin and the arming-lock wire, peening over its end. Soft-solder both pins in place. Any object weighing approximately two pounds may be used as a substitute for our bottom sensor made from molten lead. Watch for chafing where the handling line passes through the frame; rinse off the sampler after saltwater use.



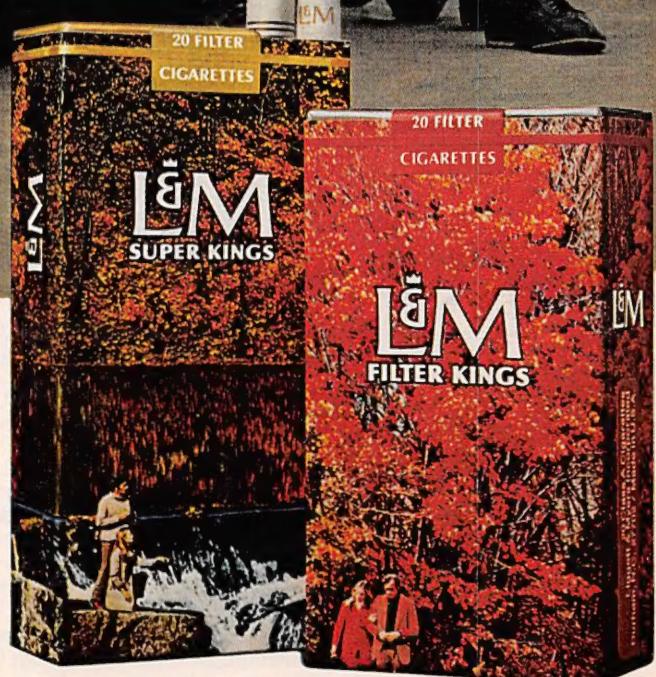
19 mg. "tar," 1.3 mg. nicotine, Super King: 19 mg. "tar," 1.4 mg. nicotine av. per cigarette, FTC Report (Apr. '72).



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